

ASITA OBONISO

17/ENG06/014

MECHANICAL ENGINEERING

ENG 282 (ASSIGNMENT 2)

1  $F = x^2 i + (3x + 2) j + \sin x k$

a,  $\frac{dF}{dx} = 2xi + 3j + \cos x k$

b,  $\frac{d^2 F}{dx^2} = 2i - \sin x k$

c,  $\left| \frac{dF}{dx} \right| = \sqrt{2^2 + 3^2 + 1^2}$

$= \sqrt{13} = 3.61$

d,  $F \cdot F = [x^2 i + (3x + 2) j + \sin x k] \cdot [x^2 i + (3x + 2) j + \sin x k]$

$F \cdot F = x^4 + (3x + 2)^2 + \sin^2 x$

$\frac{d(F \cdot F)}{dx} = 4x^3 + 2(3)(3x + 2) + 2 \cos x$

at  $x = 1$

$= 4 + 4(5) + 2(1)$

$= 36$

2  $r = (t^2 + 3t) i - 2 \sin 3t j + 3e^{3t} k$

a,  $\frac{dr}{dt} = (2t + 3) i - 6 \cos 3t j + 9e^{3t} k$

$$b, \frac{d^2 \mathbf{r}}{dt^2} = 2\mathbf{i} + 18 \sin 3t \mathbf{j} + 27e^{3t} \mathbf{k}$$

$$c, \text{ at } t = 0$$

$$= 2\mathbf{i} + 0\mathbf{j} + 27\mathbf{k}$$

$$\left| \frac{d^2 \mathbf{r}}{dt^2} \right| = \sqrt{2 + 27^2}$$

$$= 27.07$$